The Quality of California's Groundwater

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U.S. Geological Survey

Take Home Summary

- **Different constituents are important in different regions**
- **Different constituents are important at different depths – shallow domestic wells have different risks than deeper public supply wells**
- **Water use can affect water quality in unexpected ways – ex: irrigated agriculture can cause dissolution of natural inorganics into groundwater**

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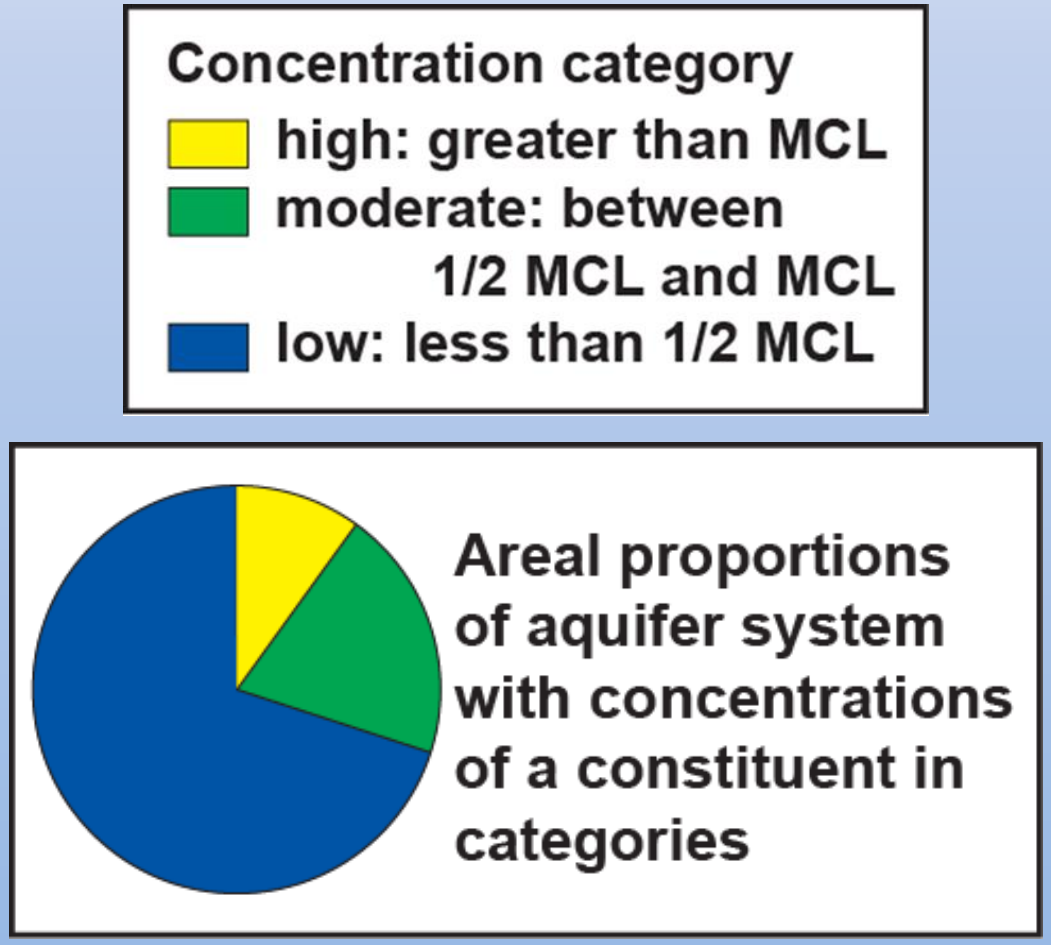
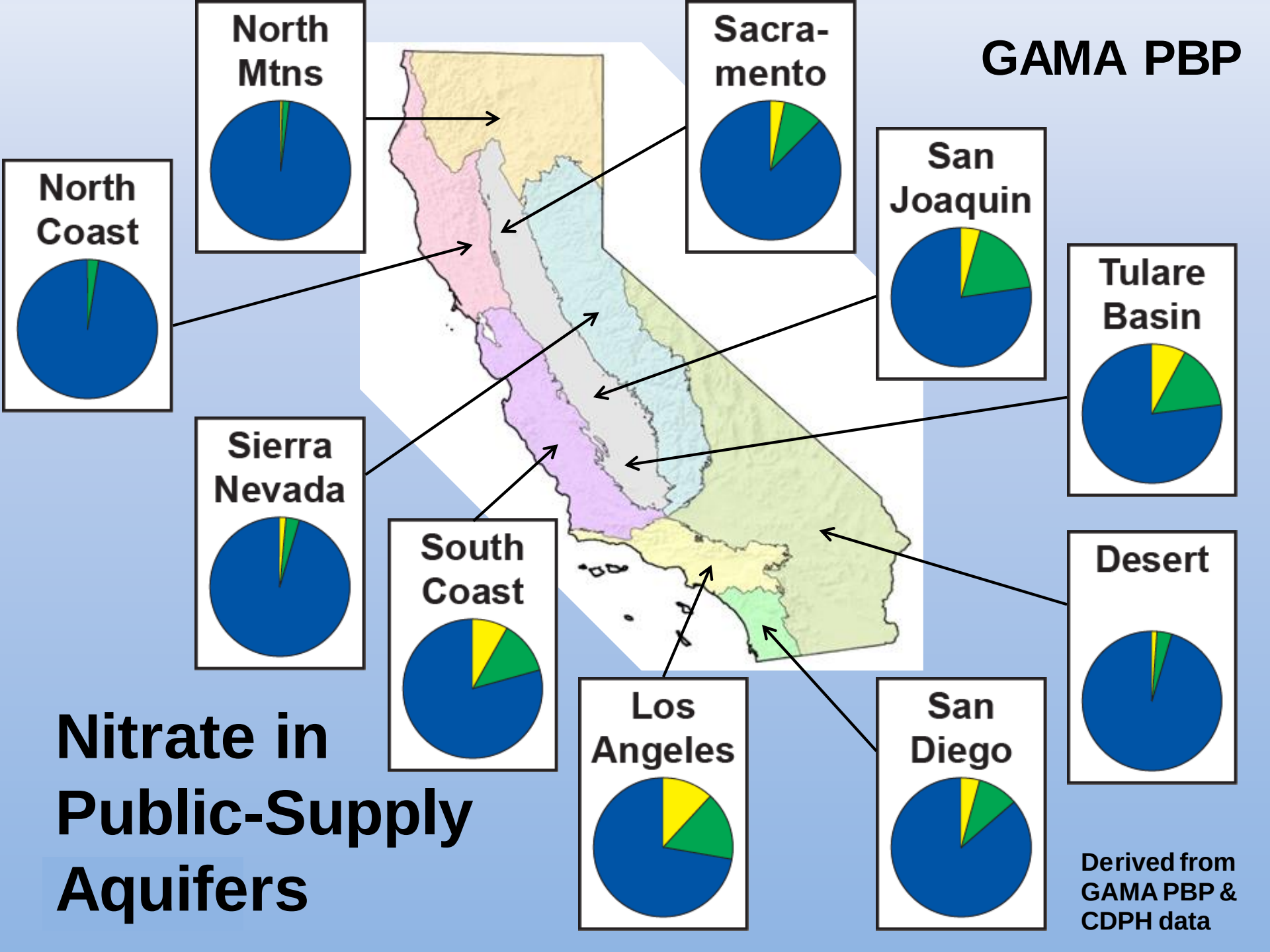
Data Presentation



MCL = USEPA or CDPH maximum contaminant level regulatory threshold for drinking water

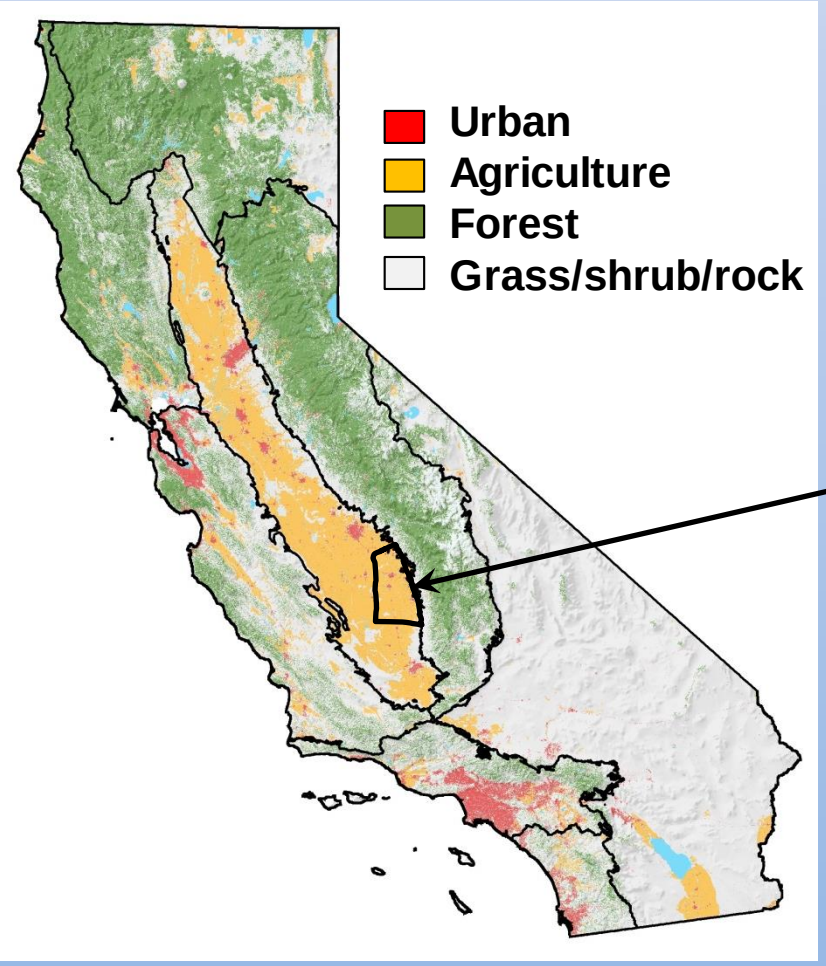
GAMA PBP



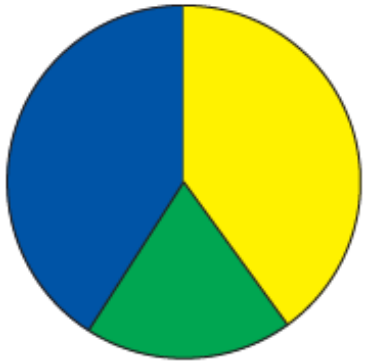
Nitrate in Public-Supply Aquifers

Derived from GAMA PBP & CDPH data

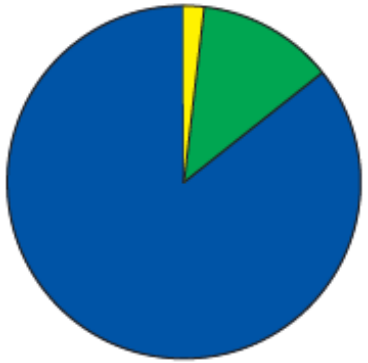
Nitrate, Well Depth, and Land Use



Western Tulare County



Shallow wells (<200 ft) Mostly domestic and small-system



Deep wells (screen >200 ft) Mostly public-supply and irrigation

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Derived from GAMA PBP, GAMA DWP & USGS NWIS data

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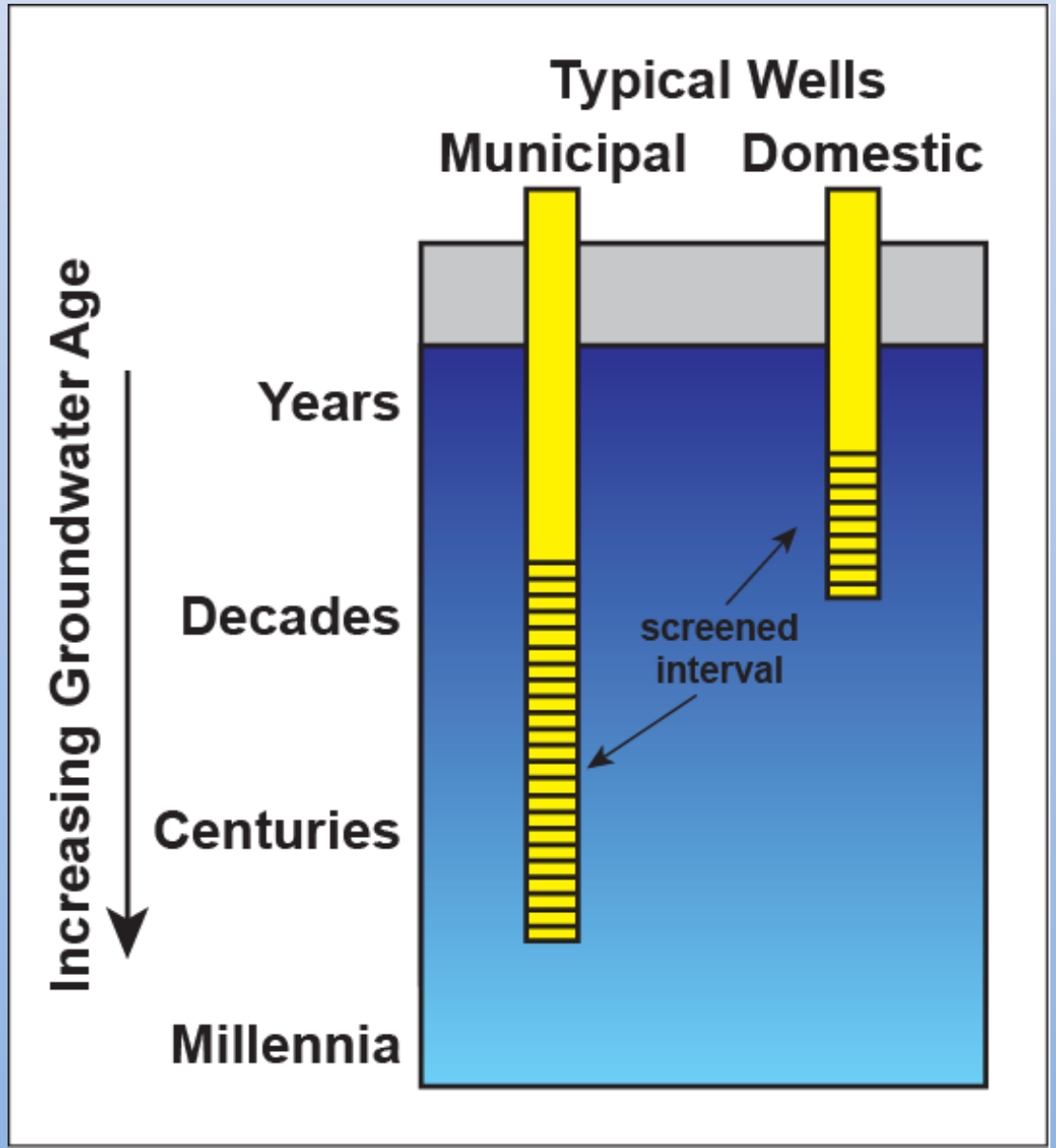
Time and Groundwater



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Nitrate

- **High nitrate mostly occurs in young, shallow groundwater in areas with agricultural history – widespread in California**
- **Data gaps in shallow aquifers – incomplete picture of spatial distribution of high nitrate**
- **Likely to affect deeper aquifers as groundwater is drawn deeper into aquifers by recharge and pumping**

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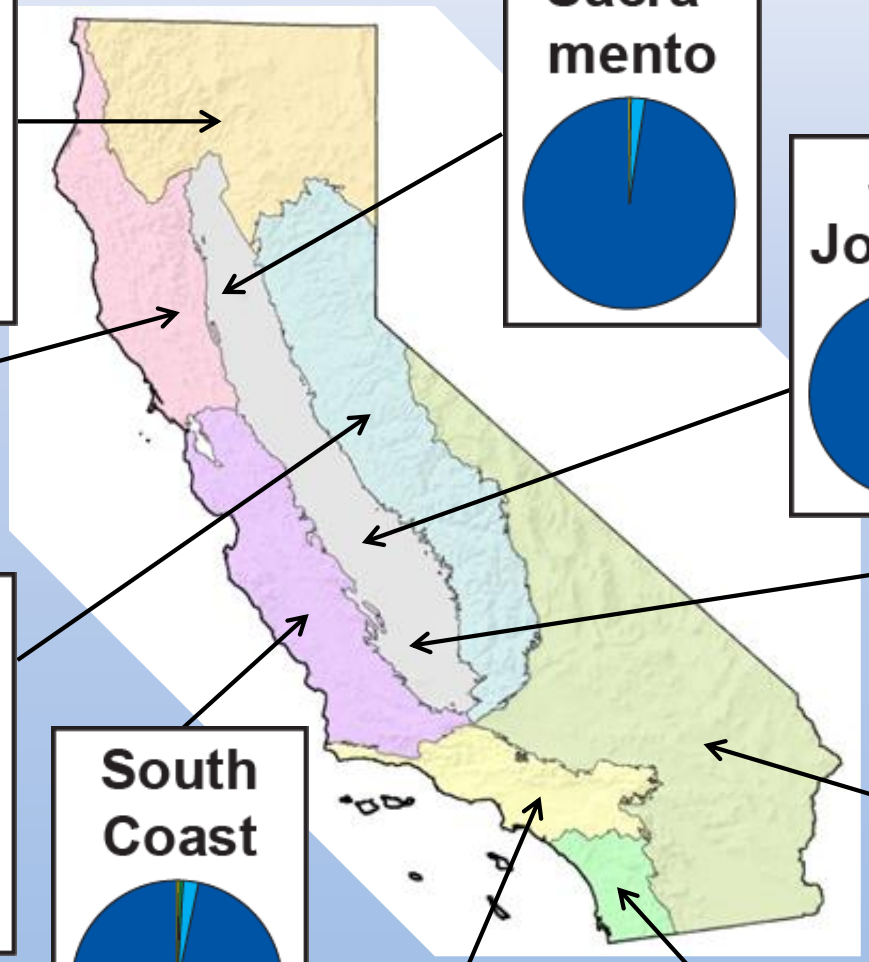
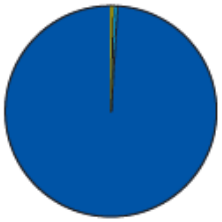
GAMA PBP



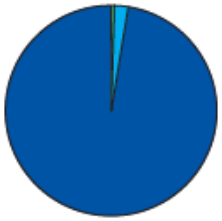
North Mtns

Sacra-mento

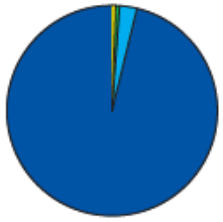
North Coast



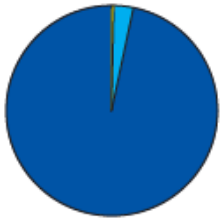
San Joaquin



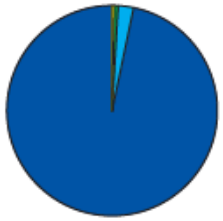
Tulare Basin



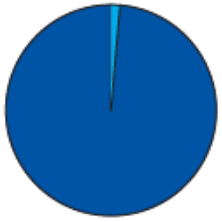
Sierra Nevada



South Coast



Desert



Los Angeles

San Diego

Solvents in Public-Supply Aquifers

Derived from GAMA PBP & CDPH data

Solvents and other industrial chemicals

- **High concentrations in public-supply aquifers mostly in areas with industrial history – mostly areas with large water agencies using advanced water treatment technologies**

- **High concentrations often associated with point sources – addressed in current regulatory structure**

- **Low concentrations widespread – where there are people, there are human-made chemicals**

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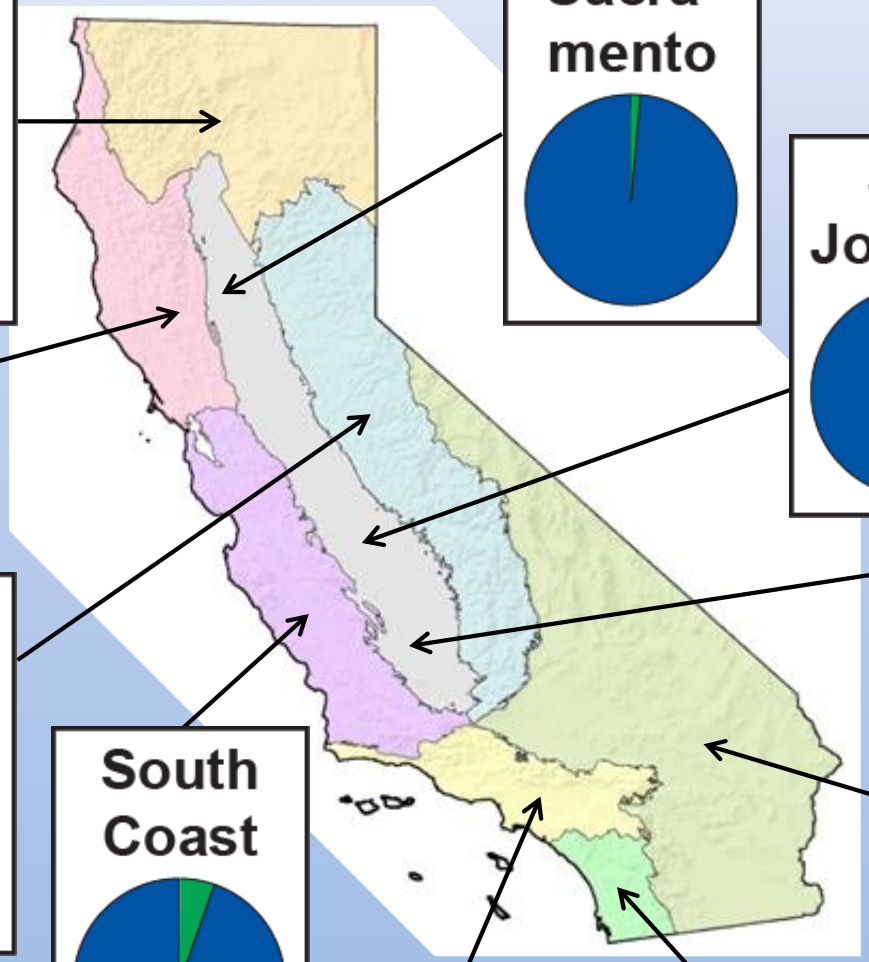
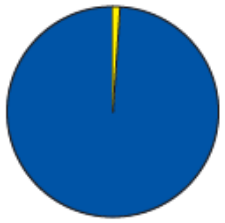
GAMA PBP



North Mtns



Sacra-mento

North Coast

San Joaquin

Tulare Basin

Sierra Nevada

South Coast

Desert

Los Angeles

San Diego

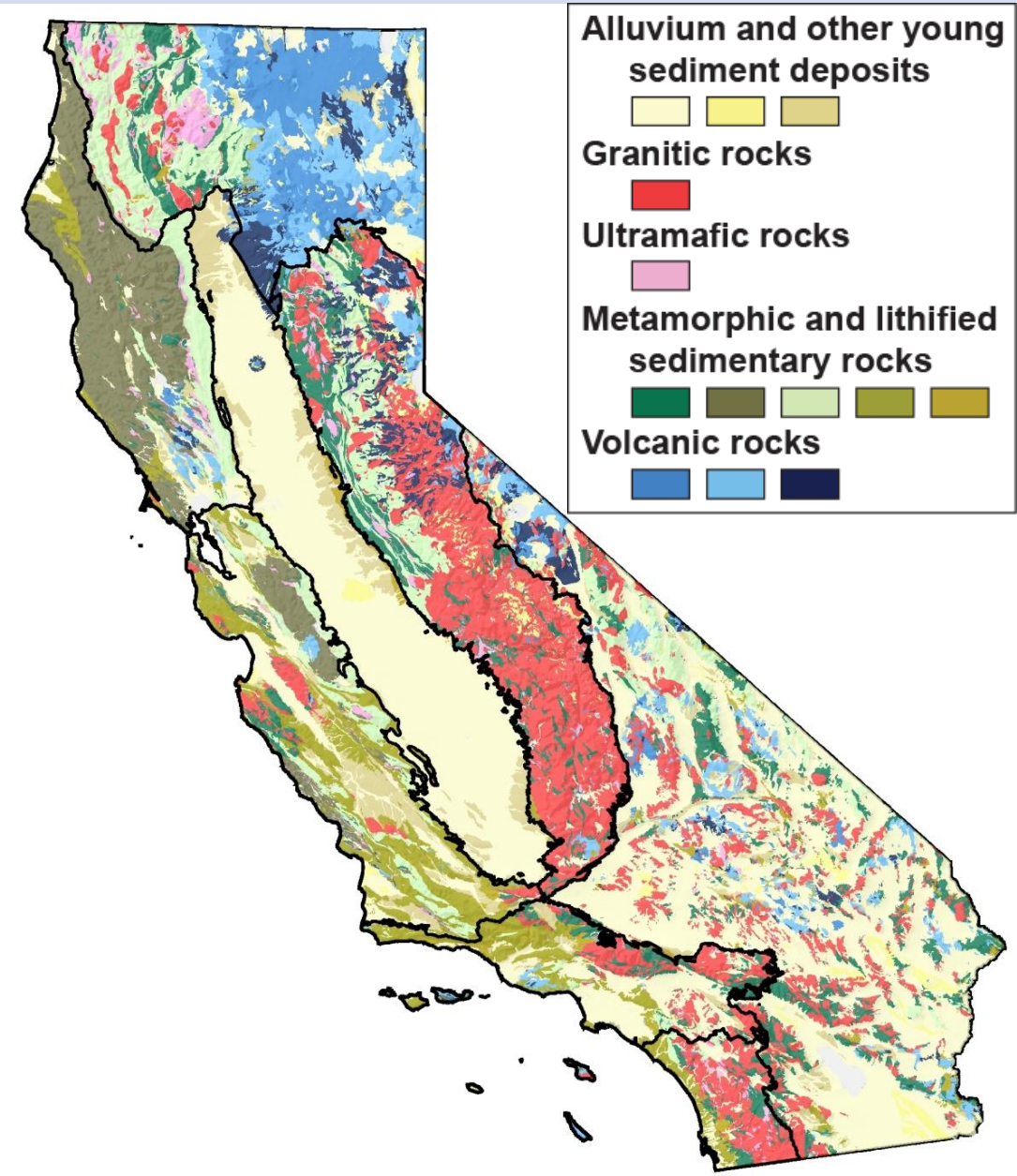
Uranium in Public-Supply Aquifers

Derived from GAMA PBP & CDPH data

Uranium

Source: granitic rocks and sediment derived from them

Dissolving uranium from minerals requires the right water chemistry



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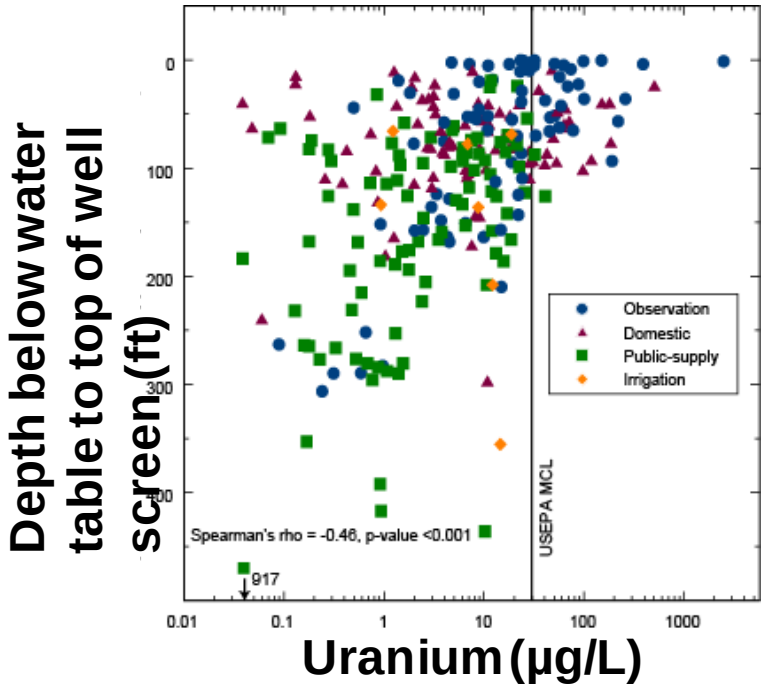
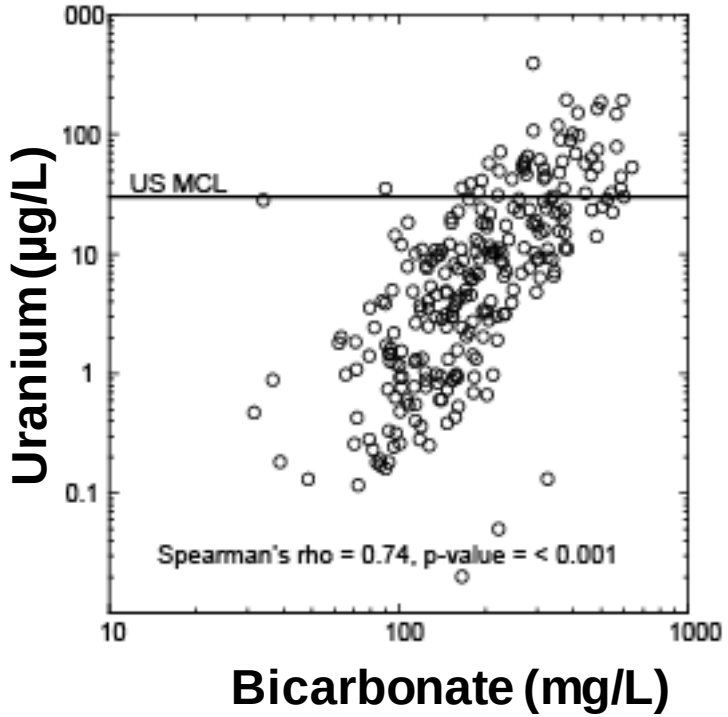
Uranium in San Joaquin and Tulare

- High uranium occurs in shallow wells, in young groundwater (<60 yrs)
- Uranium correlated with bicarbonate
- Geochemical modeling shows bicarbonate dissolves uranium off sediments
- Irrigation increases bicarbonate because it increases plant productivity





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Jurgens and others (2010)

Uranium in San Joaquin/Tulare

- **Source of uranium is natural**
- **High uranium in shallow groundwater caused by irrigated agriculture**
- **Irrigation and groundwater pumping are drawing high uranium groundwater downward – concentrations in public supply aquifers will increase with time**

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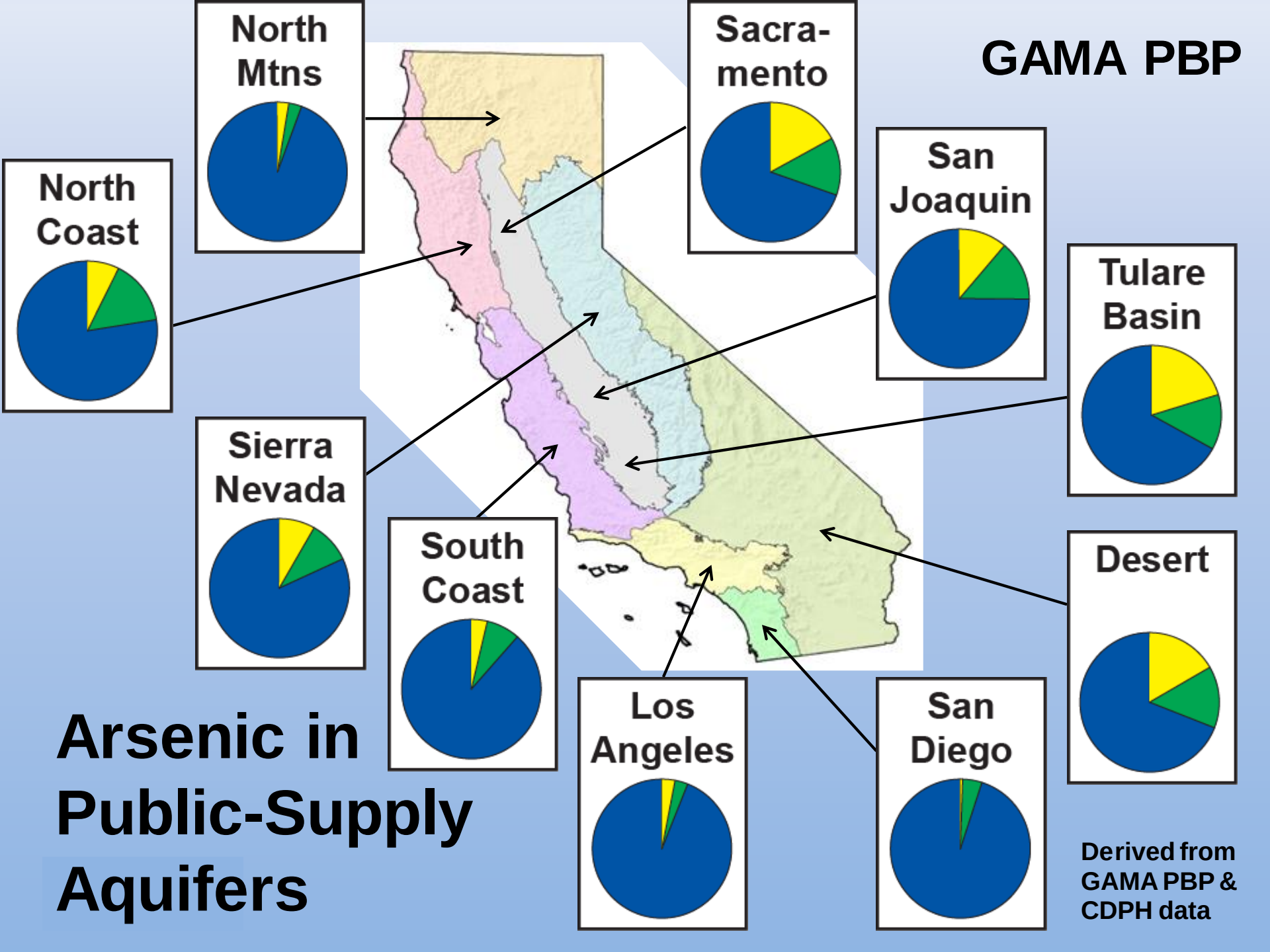
GAMA PBP



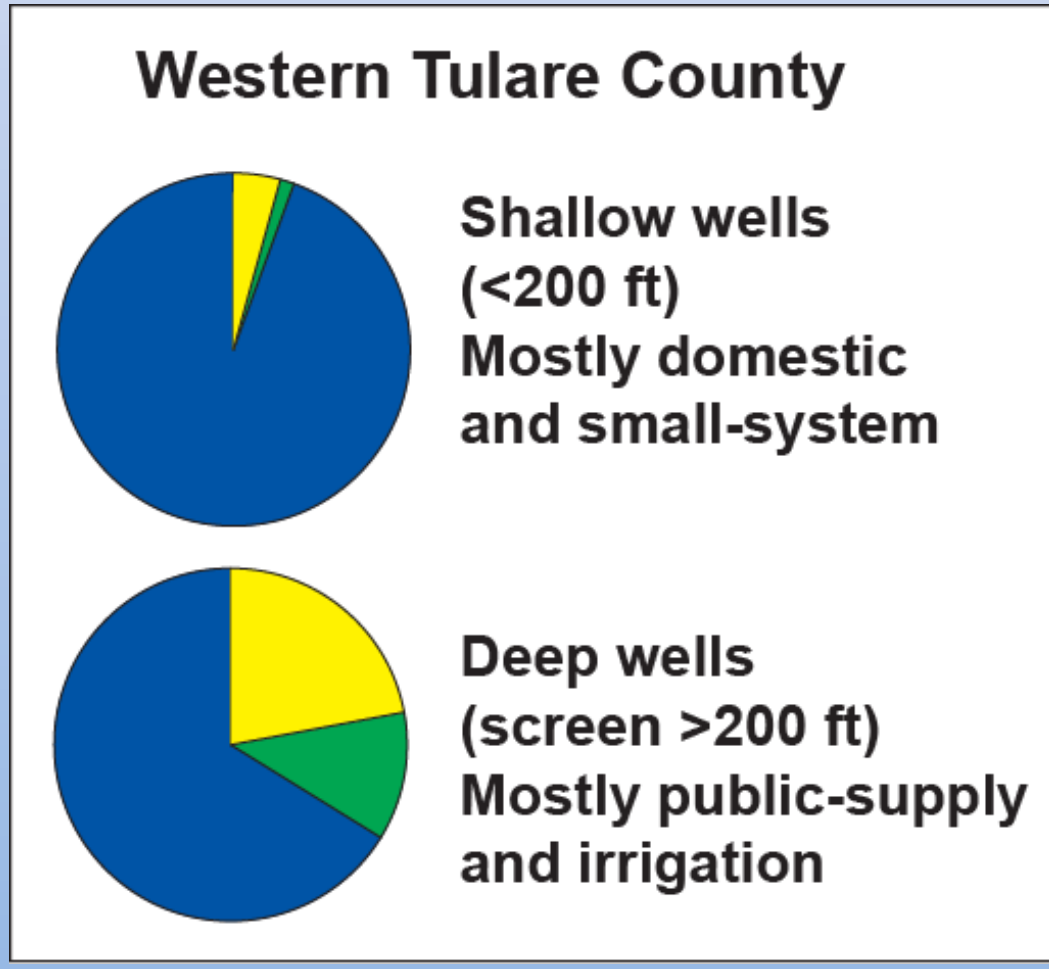
Arsenic in Public-Supply Aquifers

Derived from GAMA PBP & CDPH data

Arsenic and Water Chemistry

Arsenic is more soluble in anoxic water or in high pH oxic water

These conditions generally are more common in older water, generally deeper



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Derived from GAMA PBP,
GAMA DWP & USGS NWIS data

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Summary

- **Public-supply aquifers**
  - **Statewide, inorganic constituents (As, U, etc.) more prevalent at high concentrations than nitrate or human-made organic compounds, but there are large regional differences**

- **Shallow aquifers**
  - **Not enough data for complete assessment**
  - **More susceptible to effects from human activities**
  - **Provide estimates of future conditions in deeper aquifers**

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Effects of Human Activities on Groundwater Quality

- Water use may change groundwater quality in unexpected ways due to interactions between water chemistry and aquifer minerals

- Recharge and pumping change groundwater flow patterns and timescales during which changes in water quality occur

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Questions?

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